2008 Chesterfield WaterTrends Report of the Quality of Select Lakes, Rivers and Streams in Chesterfield County, Virginia

pH monitoring at Swift Creek near Bailey Bridge Middle School. Photo courtesy of Roy Tedesco

Chesterfield County
Department of Environmental Engineering
Water Quality Section
and
Friends of Chesterfield's Riverfronts
March 2009

Executive Summary

Water quality investigations were made at five stream, three river and within two lake stations by 25 volunteers in Chesterfield County during 2008. A basic suite of parameters was measured at each site and included pH, dissolved oxygen, water temperature and turbidity. Water depth was recorded at all lake sites and some stream and river sites. Ambient air temperature was additionally noted. Observations of general water conditions, water color, odors, debris, plants and wildlife were also recorded.

No annual medians of pH, dissolved oxygen or temperature violated Virginia Department of Environmental Quality (VADEQ) surface water standards during 2008. Observations of pH indicated that the majority of measurements made fell within the acceptable 6.0 to 9.0 unit range specified by the Virginia Department of Environmental Quality with only one instance where this range was exceeded. At the James River Station 7 (Henricus Historical Park), a measurement of 9.5 units was recorded on September 15th, most likely due to increased algal activity in the relatively low flow areas near the shore.

Dissolved oxygen concentrations were generally excellent among all sites with only a few observations not meeting the minimum 4.0 mg/L VADEQ standard. During the summer months, low dissolved oxygen was observed at several stations. Low dissolved oxygen concentrations are typically noted in summer, especially in slow moving/sluggish streams or in still lakes.

Monthly median and individual temperature measurements varied normally according to season. There were two instances in July at the James River Station 7 (Henricus Historical Park) where the temperature exceeded the 32^{o}C VADEQ standard due most likely to thermal influences from the Dominion Virginia Power effluent area upstream of the park.

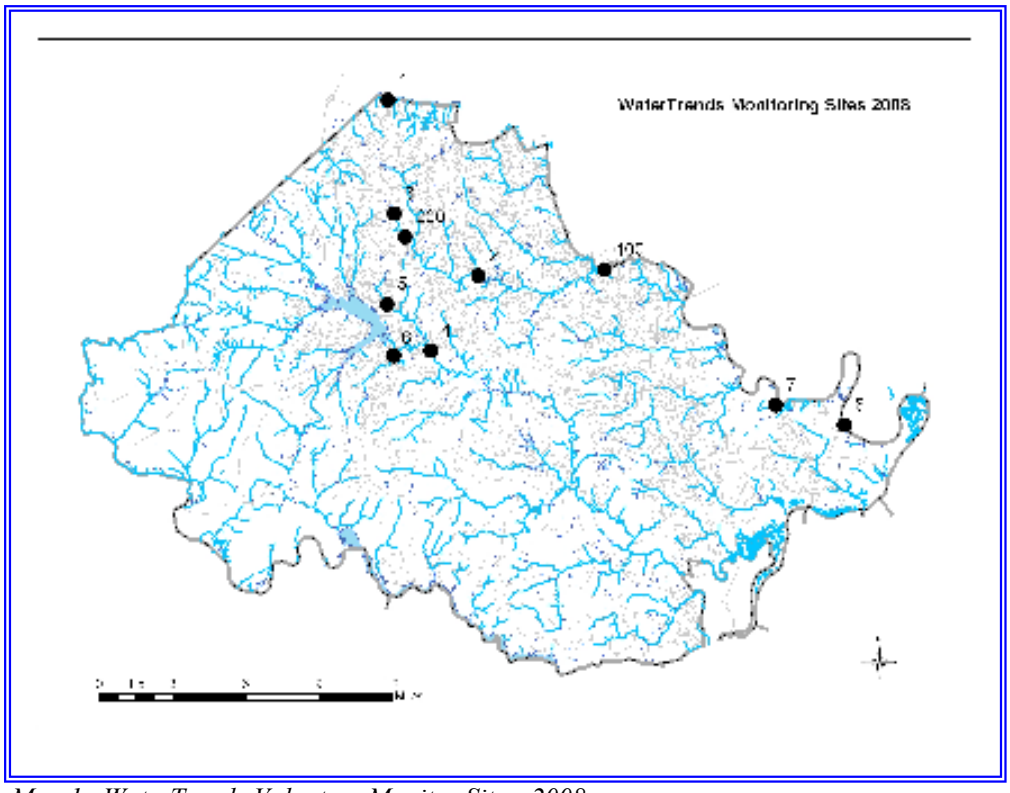
The greatest annual median transparency was observed in the James River at Robious Landing Park (Station 1; 120.0 cm) and in Spring Run (Station 6; ≥ 130.0 cm). The least clear water was observed at the Tributary to Falling Creek in the Midlothian Mines Park where the annual median transparency was calculated as 42.4 cm. Decreased turbidity can be caused by a variety of factors including abundant plant and algae growth or by suspended fine particulate matter in the stream or lake water column.

Overall in 2008, all monitored waters were stained brown to various degrees with very few unpleasant odors recorded. As in past reports, the most common “trash” item continued to be litter and leaves/debris from the watersheds. A substantial algae bloom was reported on Walton Lake during August. A variety of wildlife was observed to include numerous waterfowl, fish and turtles.

Introduction

This report presents the water quality data collected by twenty-five volunteer monitors in the Chesterfield WaterTrends Program. Historically, volunteers have collected water quality monitoring data through two separate programs coordinated by the Chesterfield County Water Quality Section and Friends of Chesterfield's Riverfront. The Chesterfield WaterTrends Program is the consolidation of the two separate programs into one effort jointly coordinated by both the Chesterfield County Water Quality Section and Friends of Chesterfield's Riverfront. Chesterfield WaterTrends sites include streams, rivers and lakes. Monitors collect data on a volunteer basis to characterize the general state of water quality at their site. This program is also included as a component of Chesterfield County's VPDES Permit VA0088609 that is executed and managed by the Chesterfield County Department of Environmental Engineering, Water Quality Section.

Chesterfield WaterTrends sites were chosen by residents with an interest in the health of their local waterbody, and also in areas where primary contact may occur (sites with public access and recreational opportunities). Chesterfield WaterTrends trainings are held two times per year in conjunction with a recertification session. Trainings are



Map 1. WaterTrends Volunteer Monitor Sites, 2008.

offered in the spring and fall. Monitors who have received training are asked to commit to the program for a period of at least one year. After their first year in the program, monitors are requested to attend an annual recertification session each subsequent year to keep their skills current. A total of three river sites, five stream sites and two lakes were monitored as part of the program in 2008. Sites on Spring Run, Nuttree Branch and a tributary to Falling Creek in Midlothian Mines Park were new sites added in 2008.

Methods

A Station ID was assigned to each Chesterfield WaterTrends site. All stream and river sites were assigned a single digit number. All lake sites were given a triple digit number, where the first two digits represent the lake and the last digit individual sampling sites on the lake. The sampling frequency for sites in the Chesterfield WaterTrends Program varied according to station type. Lake sites were sampled at least once per month at multiple stations during the growing season (approximately April – October) from docks or boats. Streams and rivers were monitored year round at least one time per month with some being monitored as frequently as weekly. A basic suite of parameters was measured at each site and included pH, dissolved oxygen, water temperature and turbidity. Water depth was recorded at lake sites and some stream and river sites. Ambient air temperature was additionally noted. Observations of general water conditions, water color, odors, debris, plants and wildlife were also recorded.

Chesterfield WaterTrends volunteers used an armored Celsius thermometer to record water and air temperature. Dissolved oxygen was measured using a modified Winkler titration (LaMotte # 5860) and pH was measured using a precision pH kit (LaMotte #5858). Turbidity was measured at lakes and most river sites using a standard eight-inch diameter Secchi disk. At stream sites, a 120 centimeter turbidity tube was used to measure water clarity. Trophic State Index values derived from the Secchi disk depths were calculated for lakes in the Chesterfield WaterTrends Program. Water depth was determined using the Secchi disk as a sounding line. In all instances when possible, duplicate measurements were made to verify readings.

Datasheets were completed in the field and entered into an electronic spreadsheet by each Chesterfield WaterTrends monitor. The electronic spreadsheets and datasheets were sent quarterly to the data coordinator. The spreadsheets were compiled and quality control was performed by the Quality Control Officer before they were uploaded into the Department of Environmental Quality's Virginia Volunteer/Non-Agency Monitoring Database.

Station Descriptions and Data Summaries

The following pages describe each site and a summary of the data and observations made during 2008. Monthly and annual median values for each monitored parameter are calculated and outlined in each site summary table when applicable. Associated maps and photographs depict the sampling station locations. Specific field data sheets for each site and monitoring survey are included in Appendix A.

Station ID: 1

Site: James River at Robious Landing Park

Latitude: 37.5591

Longitude: 77.6469

Watershed: James River

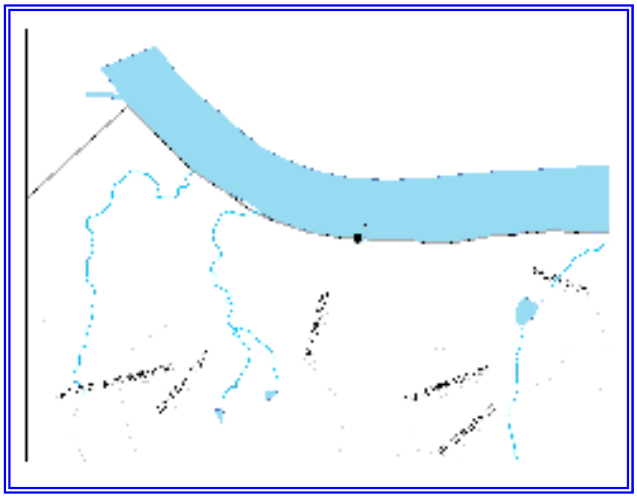
Land use: Mixed

Number of Stations: 1

Number of Monitors: 3

Hours Volunteered: 29.6

Monitoring since: August 2001



This site is located on the James River in the Northern portion of Chesterfield County within the Robious Landing county park. River measurements and water samples were obtained from the wooden boat dock at the park at least biweekly. A total of 23 surveys were conducted during 2008.

Table 1-1. Monthly and annual median values for each water quality parameter measured, 2008.

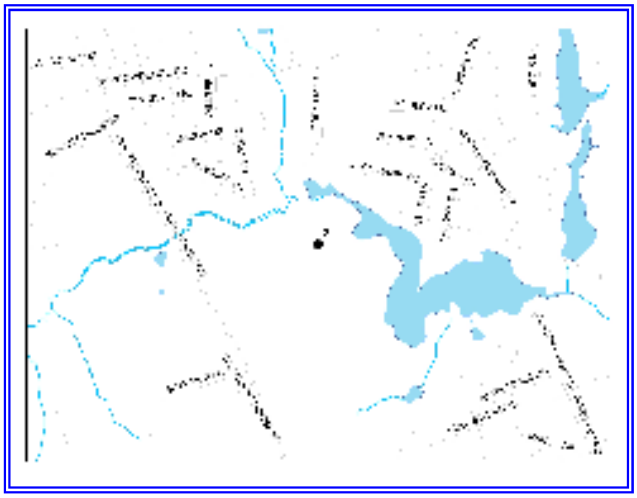
Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
February	3	*	120.0	7.5	10.8	6.0	2.0
March	2	*	79.5	7.5	9.0	11.0	16.5
April	4	*	105.0	7.3	8.0	15.3	16.5
May	3	*	49.4	7.0	7.1	19.0	17.0
June	1	*	≥130.0	7.5	7.1	30.0	32.0
July	1	*	73.0	7.5	5.8	27.0	30.0
August	2	*	≥130.0	8.0	7.4	28.3	27.5
September	1	*	10.4	6.5	5.7	23.5	25.5
October	2	*	≥130.0	8.0	8.3	17.5	18.5
November	2	*	≥130.0	7.5	10.4	10.0	13.8
December	2	*	64.0	7.3	10.9	6.0	8.8
2008 Annual Median		*	120.0	7.5	8.2	15.5	16.0

Sampling of the James River at Robious Landing Park was conducted from February through December during 2008. Sampling occurred mostly on sunny and clear days (13 surveys). Drizzle and rainy conditions were noted on two sampling dates in the spring (March and April). Normal "baseflow" conditions were noted on sixteen dates and higher flows as a result of rains were noted on six occasions. Water color ranged from "clear" and "normal" during baseflows to brown and turbid during the higher flows.

Leaves and debris followed by foams were the most often recorded floatables in the water. No odors were recorded for 2008.

Water depth was not measured at this site during 2008. Monthly median transparency values ranged from a low of 10.4 centimeters in September following heavy rains to over 130 centimeters on several occasions. The annual median transparency value (120.0 cm) was among the greatest observed at all sites during 2008 and indicated a high degree of water clarity. All monthly median pH values during the year were within the 6.0 - 9.0 unit standard range set by the Virginia Department of Environmental Quality (VADEQ). Additionally, no individual pH measurements violated the VADEQ standard during 2008. Monthly median surface temperatures ranged from 6.0 to 30.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2008. All individual dissolved oxygen concentrations were well above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters. Overall observations were indicative of good water quality at this site.

Station ID: 2



Site: Tributary to Falling Creek in Rockwood Park

Latitude: 37.4542

Longitude: 77.5804

Watershed: Falling Creek

Land use: Residential, County Park

Number of Stations: 1

Number of Monitors: 3

Hours Volunteered: 77.8

Monitoring since: August 2001

This site is located on an unnamed tributary to Falling Creek in the North Central portion of Chesterfield County within Rockwood Park. Stream measurements and water samples were obtained from the wooden bridge one quarter of a mile past the nature center on a weekly schedule. A total of 51 surveys were conducted during 2008.

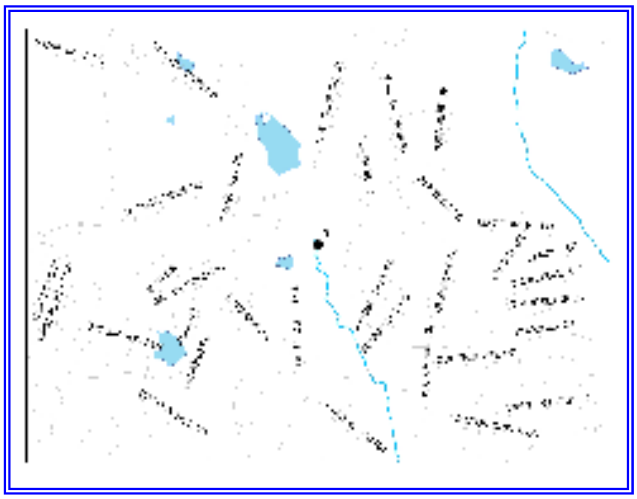
Table 1-2. Monthly and annual median values for each water quality parameter measured, 2008.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
January	3	*	42.0	6.5	15.4	3.0	6.0
February	3	*	52.0	6.5	10.6	9.0	11.5
March	5	*	98.4	6.5	9.3	13.5	20.0
April	4	*	71.5	6.5	8.5	17.5	25.8
May	6	*	68.5	6.5	6.8	18.0	23.5
June	4	*	83.5	6.5	4.6	23.5	28.0
July	5	*	105.0	6.5	5.1	22.5	26.0
August	4	*	108.5	6.5	3.9	22.0	26.0
September	4	*	≥130.0	6.5	6.3	22.5	23.8
October	5	*	≥130.0	6.5	7.2	13.0	19.5
November	4	*	102.0	6.5	7.5	7.5	10.8
December	4	*	83.4	6.5	9.9	8.0	13.0
2008 Annual Median		*	90.6	6.5	7.2	16.5	22.0

Sampling of this tributary to Falling Creek was conducted from January through December of 2008. Over half of the monitoring events (21 surveys) occurred during sunny and clear days with the remainder conducted on cloudy and/or overcast days. Normal "baseflow" conditions were noted on most all of the sampling dates with high flows noted on May 11th, 2008. Water color ranged from varying shades of brown to "dingy". Leaves and debris were noted during two visits in August and one in November. No odors were recorded for 2008.

Water depth was not measured at this site during 2008. Monthly median transparency values ranged from a low of 42.0 centimeters in January to over 130 centimeters in September and October. The annual median value (90.6 cm) was reflective of generally clear waters. All monthly median pH values during the year were all within the 6.0 - 9.0 unit standard range set by VADEQ. Additionally, no individual pH measurements violated the VADEQ standard during 2008. Measurements of pH did not vary substantially month to month during 2008 indicating a relatively stable system. Monthly median surface temperatures ranged from 3.0 to 23.5^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2008. Most all individual dissolved oxygen concentrations were above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters. The monthly median value for August (3.9 mg/L) was slightly below the VADEQ standard due to measurements made on August 13th (2.8 mg/l) and on August 22nd (2.4 mg/l). Occasional low dissolved oxygen during summer months is common in streams, especially during periods of reduced flow and higher instream temperatures. All together, the observations made were indicative of good water quality at this site.

Station ID: 3



Site: Tributary to Falling Creek in Midlothian Mines Park

Latitude: 37.4917

Longitude: 77.6429

Watershed: Falling Creek

Land use: Residential, County Park

Number of Stations: 1

Number of Monitors: 3

Hours Volunteered: 28.5

Monitoring since: June 2008

This site is located on an unnamed tributary to Falling Creek in the Northern portion of Chesterfield County within Midlothian Mines Park. Measurements and water samples were obtained from where the stream crosses the end of the abandoned railway bed trail. This trail is accessed from the parking area located off of North Woolridge Road. The stream was visited on a biweekly schedule with a total of 14 surveys conducted during 2008.

Table 1-3. Monthly and annual median values for each water quality parameter measured, 2008.

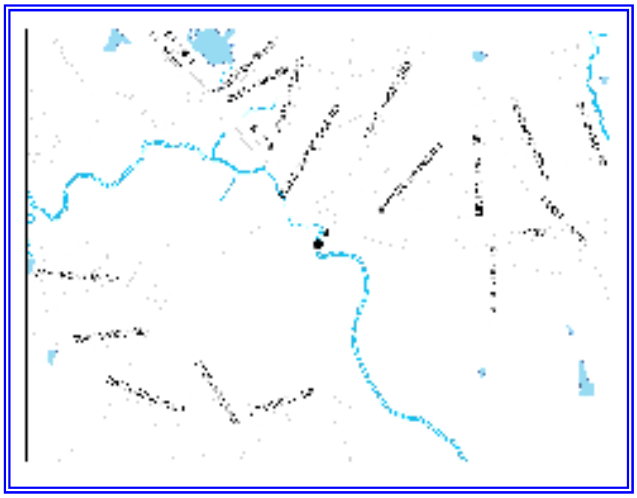
Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
June	2	*	75.2	6.5	5.5	26.3	27.3
July	2	*	53.5	6.5	5.6	27.3	25.5
August	1	*	35.6	6.0	4.3	21.0	22.0
September	2	*	42.3	6.0	6.3	24.0	26.5
October	2	*	63.8	6.0	7.5	17.3	16.5
November	2	*	70.9	6.0	8.2	13.0	13.0
December	3	*	40.0	6.0	9.6	11.0	18.5
2008 Annual Median		*	42.4	6.0	7.0	20.3	21.5

Sampling of this tributary to Falling Creek was conducted from June through December of 2008. Exactly half of the monitoring events (7 surveys) occurred during sunny and clear days with the other half conducted on cloudy and/or overcast days. Normal "baseflow" conditions were noted on six surveys. High flows were observed following Tropical Storm Hannah during September and throughout the autumn. Low flows were noted in June and late September. During the August 25th survey, flow was so low that there was not enough water to perform the testing protocol. Water color ranged from

clear through varying shades of brown. Milky conditions were observed in November and December. Leaves and debris were the most frequently observed "floatable" in the stream. "Earthy" odors were recorded during late July and early August.

Water depth was not measured at this site during 2008. Monthly median transparency values ranged from a low of 35.6 centimeters in August to 75.2 centimeters in January. The annual median value (42.4 cm) was reflective of generally cloudy waters and was the lowest annual median observed among all sites during 2008. All monthly median pH values during the year were either at the minimum 6.0 unit threshold or within the 6.0 - 9.0 unit standard range set by VADEQ. Additionally, no individual pH measurements violated the VADEQ standard during 2008. Measurements of pH did not vary substantially month to month during 2008 indicating a relatively stable system. Monthly median surface temperatures ranged from 11.0 to 27.3^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2008. All individual dissolved oxygen concentrations and consequently all monthly medians were above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters. Reduced water clarity at this site should be monitored closely to see if its source is natural or caused by human activities. Despite the lower than average clarity, all other observations were indicative of good water quality at this site.

Station ID: 4



Site: Swift Creek Near Bailey Bridge Middle School

Latitude: 37.4098

Longitude: 77.6165

Watershed: Swift Creek

Land use: Residential, Commercial School

Number of Stations: 1

Number of Monitors: 2

Hours Volunteered: 59.5

Monitoring since: August 2001

This site is located on the mainstem of Swift Creek, one of the major waterways of Chesterfield County. The site lies just downstream of the Swift Creek Reservoir in the Central portion of Chesterfield County. Stream measurements and water samples were obtained from Swift Creek downhill from the recently completed Bailey Bridge Sewage Pump Station on a weekly schedule. A total of 37 surveys were conducted during 2008.

Table 1-4. Monthly and annual median values for each water quality parameter measured, 2008.

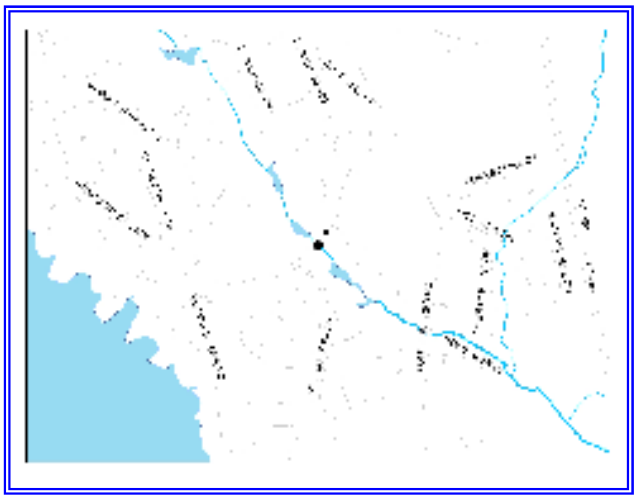
Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
January	3	*	71.0	7.0	9.6	6.0	12.0
February	3	*	61.0	7.0	10.7	7.0	8.0
March	2	*	103.0	7.0	8.9	12.5	11.8
April	4	*	89.5	6.5	7.5	17.3	22.3
May	4	*	88.5	6.5	6.8	20.5	23.5
June	3	0.47	122.0	7.0	3.8	27.0	34.0
July	3	0.43	≥130.0	7.0	3.4	25.5	30.0
August	4	0.43	112.0	7.0	4.7	26.0	28.8
September	4	0.60	103.5	6.5	5.3	23.0	27.5
October	2	0.72	≥130.0	6.5	6.1	17.5	22.3
November	3	0.72	99.0	7.0	9.0	6.5	8.0
December	2	1.73	44.5	7.0	10.6	7.5	6.5
2008 Annual Median		0.56	94.0	7.0	7.0	19.0	23.0

Sampling of Swift Creek was conducted from January through December of 2008. The majority (23) of the sampling events occurred during cloudy or overcast days and fourteen of the monitoring events were conducted during sunny and clear days. Normal "baseflow" conditions were noted on eleven surveys with high flows observed throughout the spring and winter months. High flows were also noted following Tropical Storm Hannah during September. Low or "negligible" flows were frequently recorded

throughout the summer months as well as in January. Water color ranged from clear through varying shades of brown (described also as "tea-colored") to an occasional instance of a greenish tint. Turbid waters were frequently observed following storms. Bubbles were observed in the stream during spring and algae were noted in August. "Saltwater" odors were recorded during September. Fish and turtles were the most often recorded wildlife at this site.

Water depth was measured at this station from June through December of 2008. The annual median depth for this period of record was 0.56 meters. Monthly median transparency values ranged from a low of 44.5 centimeters in December to over 130.0 centimeters in July and October. The annual median value (94.0 cm) was reflective of generally clear waters. All monthly median pH values during the year, as well as individual measurements, were within the 6.0 - 9.0 unit standard range set by VADEQ. Measurements of pH did not vary substantially month to month during 2008 indicating a relatively stable system. Monthly median surface temperatures ranged from 6.0 to 27.0^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2008. Low individual and monthly median dissolved oxygen concentrations were observed during June (median 3.8 mg/L) and July (3.4 mg/L), and one low individual measurement was also noted during the August 3rd survey. The remaining dissolved oxygen concentrations and medians were at or above VADEQ's 4.0 mg/L limit. Occasional low dissolved oxygen during summer months is common in streams, especially during periods of reduced flow and higher instream temperatures. Aside from this period of low oxygen content in the stream, all other observations were suggestive of good water quality at this site.

Station ID: 5



Site: Nuttree Branch in Brandermill

Latitude: 37.4376

Longitude: 77.6487

Watershed: Swift Creek

Land use: Residential, School

Number of Stations: 1

Number of Monitors: 1

Hours Volunteered: 21.0

Monitoring since: April 2008

This site is located on Nuttree Branch in the West Central area of Chesterfield County at Swift Creek Elementary School on Genito Road. Stream measurements and water samples were obtained at least biweekly near a small footbridge on a bike path accessed from the Brandermill Country Club. A total of 17 surveys were conducted during 2008.

Table 1-5. Monthly and annual median values for each water quality parameter measured, 2008.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
April	1	*	24.0	6.5	7.1	17.0	16.0
May	3	*	43.6	6.5	7.0	22.5	21.0
June	2	*	78.9	6.5	5.6	25.3	32.3
July	3	*	79.2	6.5	4.6	25.0	28.0
August	2	*	63.9	6.5	4.2	22.3	26.0
September	2	*	32.5	6.5	7.5	22.5	24.5
October	1	*	56.0	6.5	9.7	17.0	18.0
November	1	*	91.0	6.5	12.1	10.5	9.5
December	2	*	34.5	6.5	10.2	7.3	8.7
2008 Annual Median		*	56.0	6.5	7.0	22.5	24.0

Sampling of Nuttree Branch was conducted from April through December of 2008. All but three survey events occurred during sunny and clear days. Normal "baseflow" conditions were noted on six of the surveys and high flows were observed on two occasions in April and December. Low or "negligible" flows were observed throughout the summer and autumn months with areas of visible dryness noted in July. Water color was typically recorded as varying shades of brown. Leaves and debris were the most frequently noted "floatable" within the channel and trash was observed in July. "Earthy" odors were observed in late June and throughout July.

Water depth was not measured at this site during 2008. Monthly median transparency values ranged from a low of 24.0 centimeters in April to 91.0 centimeters in November. The annual median value (56.0 cm) was reflective of relatively cloudy waters. All monthly median pH values during the year, as well as individual measurements, were identical (6.5 units) and were within the 6.0 - 9.0 unit standard range set by VADEQ. Measurements of pH did not vary at all month to month during 2008 indicating a very stable system. Monthly median surface temperatures ranged from 7.3 to 25.3^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2008. All individual dissolved oxygen concentrations and consequently all monthly medians were above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters All together, the observations made during 2008 were indicative of good water quality at this site.

Station ID: 6

Site: Spring Run Behind Birdsong Lane

Latitude: 37.4073

Longitude: 77.6441

Watershed: Swift Creek

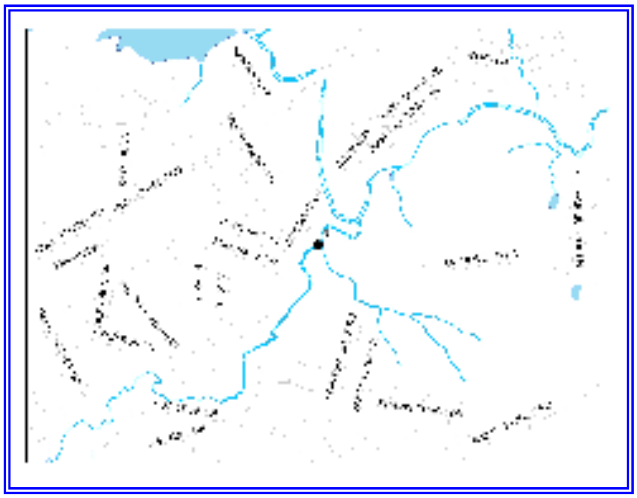
Land use: Residential

Number of Stations: 1

Number of Monitors: 2

Hours Volunteered: 27.8

Monitoring since: April 2008



This site is located on Spring Run in the West Central area of Chesterfield County at a private residence on Birdsong Lane within the Mockingbird Hills subdivision. Stream measurements and water samples were obtained weekly at the site. A total of 26 surveys were conducted during 2008.

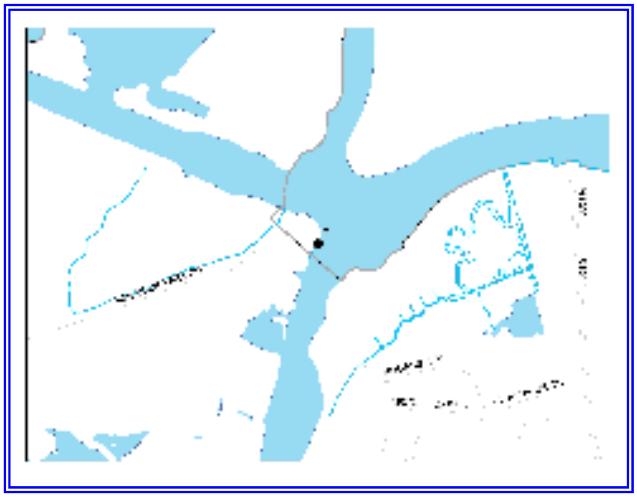
Table 1-6. Monthly and annual median values for each water quality parameter measured, 2008.

Date	n	Water Depth (m)	Transparency (cm)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
April	1	*	70.0	7.0	7.0	19.0	24.5
May	3	*	55.2	7.0	7.3	18.5	23.5
June	2	*	≥130.0	7.0	6.7	24.5	31.3
July	3	*	≥130.0	7.0	6.5	23.0	28.5
August	3	*	≥130.0	7.0	6.5	22.4	28.5
September	4	*	123.0	7.0	7.1	22.1	25.6
October	4	*	≥130.0	7.0	8.6	15.5	19.8
November	4	*	≥130.0	7.0	8.6	12.5	19.0
December	2	*	48.5	7.0	9.3	10.2	12.8
2008 Annual Median		*	≥130.0	7.0	7.2	18.5	23.0

Sampling of Spring Run was conducted from April through December of 2008. Clear and sunny days were noted on 16 of the sampling events. Cloudy or overcast days were recorded for eight samplings and rain showers were present on two. Normal "baseflow" conditions were noted on most of the surveys with only two high flows events observed following rains in November and December. There were no instances of low or "negligible" flows during 2008. Clear water was observed on sixteen occasions and turbid conditions were noted on the remaining ten. Leaves and debris were the only noted "floatable" within the channel and were only mentioned during the November surveys. No perceptible odors were recorded during 2008. Water striders were observed in late May and early June.

Water depth was not measured at this site during 2008. Monthly median transparency values ranged from a low of 48.5 centimeters in December to over 130.0 centimeters on multiple occasions. The annual median value (≥ 130.0 cm) was the greatest observed among all sites during 2008 and was characteristic of a high degree of water clarity. All monthly median pH values during the year, in addition to individual measurements, were identical (7.0 units) and were well within the 6.0 - 9.0 unit standard range set by VADEQ. Measurements of pH did not vary at all month to month during 2008 indicating a very stable system. Monthly median surface temperatures ranged from 10.2 to 24.5^{o}C and varied normally with season. No individual values exceeded the VADEQ standard of 32.0^{o}C during 2008. All individual dissolved oxygen concentrations and consequently all monthly medians were well above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters All together, the observations made were characteristic of very good water quality at this site.

Station ID: 7



Site: James River at Henricus Historical Park

Latitude: 37.3749

Longitude: 77.3605

Watershed: James River

Land use: Mixed

Number of Stations: 1

Number of Monitors: 2

Hours Volunteered: 16.0

Monitoring since: August 2001

This site is located on the James River in the Eastern portion of Chesterfield County within the Henricus Historical Park. River measurements and water samples were obtained from the floating dock at the end of the path leading east of the park at least biweekly. A total of 23 surveys were conducted during 2008.

Table 1-7. Monthly and annual median values for each water quality parameter measured, 2008.

Date	n	Water Depth (m)	Secchi Depth (m)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
April	2	*	1.37	7.5	7.2	19.0	15.5
May	4	*	0.94	7.5	8.3	20.5	17.5
June	2	*	1.00	7.5	6.6	31.0	26.0
July	3	*	1.14	7.5	7.3	34.0	28.0
August	2	*	0.81	7.8	5.7	28.0	18.5
September	3	*	0.76	7.5	7.1	27.0	24.0
October	2	*	0.91	7.5	7.2	21.0	15.5
November	3	*	0.84	7.5	9.9	17.0	10.0
December	2	*	0.81	7.5	10.5	9.5	6.0
2008 Annual Median		*	0.97	7.5	7.3	23.0	16.0

Sampling of the James River at Henricus Historical Park was conducted from April through December during 2008. Twelve sampling events occurred on clear and sunny days while six surveys were conducted on cloudy or overcast days. Five site visits were held on days in which showers and/or light rains were present. Normal "baseflow" conditions were noted on all but two monitoring events. Two observations of high water were noted in November and December. Clear water was recorded on fourteen visits during 2008. A greenish hue was observed in the spring and varying shades of brown were noted during the autumn. Instances of trash, leaves and debris, followed by algae, were observed throughout the year. An "earthy" odor was perceptible during late August

and early September and a "fishy" odor was recorded in late July. No other incidents of noticeable odors were recorded for the rest of the monitoring dates in 2008. Buzzards, catfish and spawning herring were among the wildlife observed at this site.

Water depth was not measured at this site during 2008. A Secchi disk was used to measure the clarity of the river. Monthly median Secchi disk transparency values ranged from a low of 0.76 meters in September to 1.37 meters in April. The annual median Secchi disk transparency value was 0.97 meters and indicated an acceptable degree of water clarity. All monthly median pH values during the year were within the 6.0 - 9.0 unit standard range set by VADEQ. There was one instance in which pH was above the upper range of acceptability (9.0 units) set by the VADEQ. A measurement of 9.5 units was recorded on September 15th during relatively normal river conditions. This high reading was most likely due to increased algal activity in the relatively low flow areas near the shore and since it was an isolated event, should not be considered alarming. Monthly median surface temperatures ranged from 9.5 to 34.0^{o}C and varied normally with season. Two readings in July (34.0^{o}C each), as well as the median for that month (34.0^{o}C) exceeded the VADEQ standard of 32.0^{o}C, due most likely to thermal influences from the Dominion Virginia Power effluent area upstream of the park. All individual dissolved oxygen concentrations and monthly medians were well above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters. With the exception of the standard violations, all of the observations were indicative of generally good water quality at this site.

Station ID: 8

Site: James River Near Enon

Latitude: 37.3631

Longitude: 77.3091

Watershed: James River

Land use: Mixed

Number of Stations: 1

Number of Monitors: 1

Hours Volunteered: 60.8

Monitoring since: August 2001

This site is located on the James River in the Eastern portion of Chesterfield County within the Mount Blanco subdivision. River measurements and water samples were obtained from a private dock located on Mount Blanco Road on a weekly basis. A total of 43 surveys were conducted during 2008.

Table 1-8. Monthly and annual median values for each water quality parameter measured, 2008.

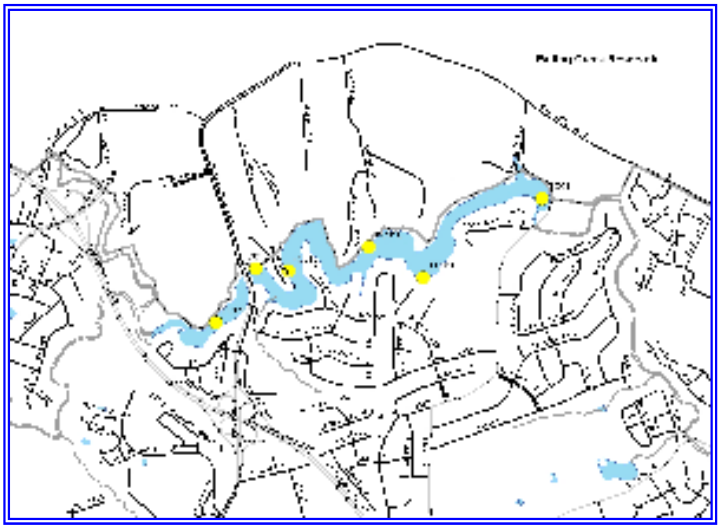
Date	n	Water Depth (m)	Secchi Depth (m)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)
January	3	1.90	0.60	7.5	10.3	6.0	2.5
February	3	2.10	0.70	7.5	10.3	7.5	12.0
March	2	1.70	0.65	7.5	10.4	11.8	13.8
April	4	2.00	0.70	7.5	8.3	16.5	15.3
May	3	2.10	0.40	7.5	8.2	21.0	20.0
June	5	1.70	0.50	7.5	7.9	31.0	32.5
July	4	1.95	0.45	8.0	6.9	30.5	28.3
August	4	2.05	0.45	7.8	7.3	27.8	24.0
September	4	2.30	0.50	7.0	5.8	25.0	23.8
October	4	2.05	0.55	7.5	8.8	20.3	21.0
November	4	1.65	0.60	7.5	9.7	12.3	11.5
December	3	2.10	0.60	7.5	10.5	9.0	8.5
2008 Annual Median		2.00	0.60	7.5	8.6	19.0	21.0

Sampling of the James River at the Enon site was conducted from January through December of 2008. Thirty-three sampling events occurred on cloudy or overcast days while twelve surveys were conducted on clear and sunny days. Two site visits were held on days in which drizzle or intermittent rain showers were present. Normal "baseflow" conditions were noted on 29 monitoring events. Ripples and small waves were recorded on eight site visits. Five observations of high water were noted in summer and autumn and an instance of low flow was observed in October. Light brown was the most often recorded color during 2008 with 26 observations. Greenish brown hues were noted on

two site visits in mid-July. Instances of trash, leaves/debris, and foam/bubbles were observed throughout the year. No perceptible odors were recorded during 2008.

Monthly median water depth at this station ranged from 1.65 meters in November to 2.30 meters in September. The annual median water depth was 2.00 meters. At this site, a Secchi disk was used to measure the clarity of the river. Monthly median Secchi disk transparency values ranged from a low of 0.40 meters in May to a high of 0.70 meters in February and April. The annual median Secchi Disk transparency value was 0.60 meters and indicated a slightly lower degree of water clarity. All individual measurements and monthly median pH values during the year were within the 6.0 - 9.0 unit standard range set by VADEQ. Monthly median surface temperatures ranged from 6.0 to 31.0^{o}C and varied normally with season. All individual dissolved oxygen concentrations and monthly medians were well above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters. All of the observations at this station were suggestive of generally good water quality.

Station ID: 100 (101-106)



Falling Creek Reservoir

Surface Acreage: 91

Latitude: 37.4589

Longitude: 77.4785

Watershed: Falling Creek

Land use: Residential and commercial

Number of Stations: 6

Number of Monitors: 7

Hours Volunteered: 56.8

Monitoring Since: Spring 2003

Falling Creek Reservoir is a manmade lake that was established in 1951. It was utilized as a drinking water source for Chesterfield County until 1985. Local residents concerned about the long-term health of the reservoir formed the Falling Creek Reservoir Preservation Society in 2002 and began volunteer monitoring the following year. The reservoir is surrounded by homes that have generally forested lots and small well-maintained lawns. The topography around the lake is quite steep. The watershed is a mix of commercial and residential uses. The lake is bordered by the City of Richmond to the north, while the lake itself and land to the south is in Chesterfield County.

Table 1-9. Monthly and annual median values for each water quality parameter measured, 2008.

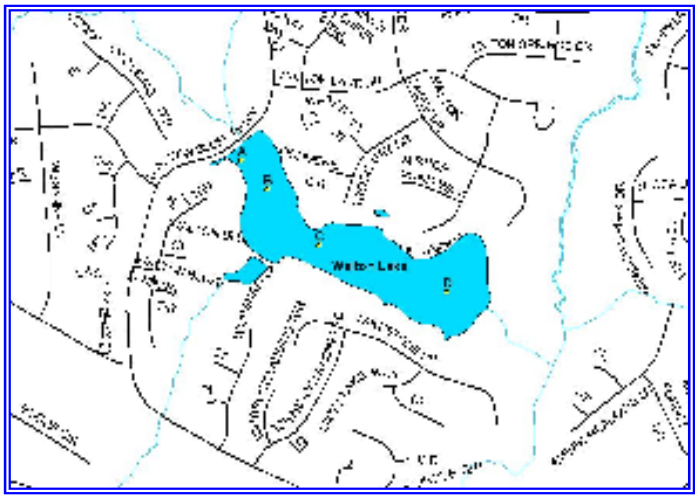
Date	n	Water Depth (m)	Secchi Depth (m)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)	Trophic State Index Value
May	12	1.54	0.76	6.5	8.0	20.0	20.0	64
June	12	1.46	0.79	7.0	8.1	28.0	27.0	63
July	6	1.48	0.64	7.0	8.5	27.0	26.3	66
August	6	1.73	0.79	7.0	5.8	27.0	22.0	63
September	2	1.59	0.84	7.0	8.6	21.5	15.3	63
October	11	1.68	1.05	6.0	7.6	18.0	13.0	59
2008 Annual Median		1.55	0.79	6.5	7.9	22.0	22.0	63
2007 Annual Median		*1.54*	*0.93*	*6.5*	*7.7*	*24.0*	*23.0*	*61*
2006 Annual Median		*1.47*	*1.07*	*6.5*	*7.0*	*21.3*	*22.0*	*59*
2005 Annual Median		*	*	*	*	*	*	*
2004 Annual Median		*1.69*	*0.80*	*5.5*	*	*25.0*	*24.0*	*63*

Sampling was conducted at six sites on the Falling Creek Reservoir from May to October of 2008. Sampling occurred mostly on clear and sunny days with water conditions generally calm. Litter, leaves and debris were noted throughout the year at all sites. Although occasional earthy odors were recorded, volunteers reported no perceptible

odors at most sites and on most surveys. A variety of water fowl to include Canada geese, ducks, cormorants, swans, heron, hawks and kingfishers were observed.

The annual median water depth for Falling Creek Reservoir was 1.55 meters, approximately the same as observed the previous year (1.54 meters). All monthly median pH values were within the 6.0 - 9.0 unit standard range set by VADEQ with an annual median pH (6.5 units) identical to the 2006 and 2007 medians. No individual measurements violated VADEQ standards. Monthly median surface temperatures ranged from 18.0 to 28.0^{o}C and varied normally with season. All individual dissolved oxygen concentrations were well above VADEQ's 4.0 mg/L limit and were indicative of well oxygenated waters. Water color observations ranged from clear with a brown hue to brown/turbid during the year. Median Secchi disk depths ranged from 0.64 to 1.05 meters with an annual median of 0.79 meters, similar to the median Secchi disk depth observed in 2004. This represented the third year of decreasing clarity as measured by Secchi disk depth. Trophic State Index values also reflected this decrease and consequently were similar to conditions observed prior to the 2005 dam repair. The Trophic State Index values continued to indicate that the lake is a borderline moderately eutrophic/eutrophic body of water (index value ~60). Hypereutrophic conditions (index values > 70) were not observed in 2008.

Station ID: 200 (201-204)



Lake: Walton Lake

Surface Acreage: 26

Latitude: 37.4772

Longitude: 77.6325

Watershed: Falling Creek

Land use: Residential

Number of Stations: 4

Number of Monitors: 1

Hours Volunteered: 25.1

Monitoring since: Spring 2004

Walton Lake is a manmade waterbody that was constructed and used as an amenity for the Isaac Walton League Hunt Club until the mid 1980's. The current dam was built in 1988 with the establishment of the Walton Lake subdivision. Homes surround the entire lake with the majority of the lakeside buffer as residential lawn. Residents utilize the lake for recreation such as boating and fishing. The entire watershed is built out in both residential and commercial development. This year marked the third consecutive season of sampling since monitoring was temporarily suspended in 2005.

Table 1-10. Monthly and annual median values for each water quality parameter measured, 2008.

Date	n	Water Depth (m)	Secchi Depth (m)	pH (units)	Dissolved Oxygen (mg/L)	Surface temperature (°C)	Air Temperature (°C)	Trophic State Index Value
April	4	1.37	1.14	7.0	4.1	20.0	22.0	58
May	4	1.36	0.84	7.0	4.0	22.0	22.0	63
June	4	1.22	0.85	7.0	3.5	28.0	28.0	62
July	4	1.28	0.98	7.0	3.5	27.0	31.0	60
August	3	1.11	0.47	7.0	4.3	27.0	29.0	71
September	4	1.36	0.78	7.0	5.9	22.0	23.0	64
October	4	1.25	0.70	6.0	4.4	12.0	12.0	65
	2008 Annual Median	1.31	0.84	7.0	4.1	22.0	23.0	63
	2007 Annual Median	*1.39*	*0.67*	*6.0*	*4.6*	*28.0*	*26.0*	*66*
	2006 Annual Median	*1.44*	*0.84*	*6.0*	*	*24.0*	*23.0*	*63*
	2005 Annual Median	*	*	*	*	*	*	*
	2004 Annual Median	*1.31*	*1.00*	*5.5*	*	*28.0*	*23.0*	*60*

Sampling at Walton Lake was conducted from April to October at four sites during 2008. Sampling occurred mostly on partly cloudy or overcast days with water conditions relatively calm (ripples). Algae clumps were reported throughout the year with a significant algae bloom recorded and characterized during August. This algae was

sampled and identified as *Cylindrospermopsis raciborskii*, a blue-green algae noted for imparting a characteristic brown tint to waters. This brown color was observed throughout most of the monitoring season. Although an occasional earthy odor was recorded, no widespread perceptible odors were noted at most sites during surveys. In addition to the extensive algae, Canada geese, carp, muskrat and lily pads were among the organisms observed during 2008.

The annual median water depth for Walton Lake was 1.31 meters, precisely the same as observed in 2004. Monthly median pH values during the year were all within the 6.0 - 9.0 unit standard range set by VADEQ. Additionally, no individual pH measurements violated the VADEQ standard during 2008. This was an improvement from the previous year where three monthly medians indicated observations of low pH. Monthly median surface temperatures ranged from 12.0 to 28.0^{o}C and varied normally with season. Dissolved oxygen measurements made on Walton Lake during 2008 indicated two consecutive months (June and July) of low oxygen content in the surface waters (<4.0 mg/L). While low dissolved oxygen is more likely to be observed during periods of warmer weather, low concentrations at or near the surface may lead to an increased chance of fish kills. Monthly median Secchi disk depths ranged from 0.47 to 1.14 meters with an annual median of 0.84 meters. This represented an increase in water clarity to the condition observed in 2006. Likewise, the annual median Trophic State Index value decreased slightly compared to the previous year with the annual median value (63) identical to the annual median value observed in 2006. Measurements over the past four years have suggested that Walton Lake is a biologically productive and mildly eutrophic body of water. As mentioned in previous reports, further observations on Walton Lake with particular emphasis on the visual assessments of algae blooms and potential for fish kills should be conducted.

Discussion

Measurements of water quality were made at eight stream and river stations and within two lake stations by volunteers in Chesterfield County during 2008. A summary of the parameters measured during the course of the year are presented in Table 2. No annual medians of pH, dissolved oxygen or temperature violated Virginia Department of Environmental Quality (VADEQ) surface water standards during 2008.

Table 2. A summary of parameters measured among 10 stations in Chesterfield County, 2008. Asterisks indicate no measurements made for that parameter.

Site	n	Statistic	Water Depth (m)	Transparency (cm)	Secchi Depth (m)	pH (units)	Dissolved Oxygen (mg/L)	Surface Temperature (oC)	Air Temperature (oC)
James River @ Robious	23	Minimum	*	10.4	*	6.5	5.7	0.0	-0.2
WaterTrends Station ID: 1		Median	*	120.0	*	7.5	8.2	15.5	16.0
Volunteer Hours: 29.6		Maximum	*	≥130.0	*	8.0	12.0	30.0	32.0
Rockwood Park	51	Minimum	*	21.0	*	6.0	2.4	2.0	4.5
WaterTrends Station ID: 2		Median	*	90.6	*	6.5	7.2	16.5	22.0
Volunteer Hours: 77.8		Maximum	*	≥130.0	*	6.5	16.1	25.0	33.0
Midlothian Mines	14	Minimum	*	17.8	*	6.0	4.3	8.0	5.5
WaterTrends Station ID: 3		Median	*	42.4	*	6.0	7.0	20.3	21.5
Volunteer Hours: 28.5		Maximum	*	111.0	*	7.0	9.8	27.5	29.0
Swift Creek @ Bailey Bridge	37	Minimum	0.33	31.0	*	6.5	1.9	4.0	-0.5
WaterTrends Station ID: 4		Median	0.56	94.0	*	7.0	7.0	19.0	23.0
Volunteer Hours: 59.5		Maximum	2.13	≥130.0	*	7.0	11.3	28.0	35.0
Nuttree @ Brandermill	17	Minimum	*	16.0	*	6.5	4.0	7.0	8.5
WaterTrends Station ID: 5		Median	*	56.0	*	6.5	7.0	22.5	24.0
Volunteer Hours: 21.0		Maximum	*	91.0	*	6.5	12.1	27.0	33.0
Spring Run @ Birdsong Lane	26	Minimum	*	27.4	*	7.0	6.3	7.0	4.5
WaterTrends Station ID: 6		Median	*	≥130.0	*	7.0	7.2	18.5	23.0
Volunteer Hours: 27.8		Maximum	*	≥130.0	*	7.0	10.7	25.0	32.0
James River @ Henricus	23	Minimum	*	*	0.41	7.5	5.6	7.0	6.0
WaterTrends Station ID: 7		Median	*	*	0.97	7.5	7.3	23.0	16.0
Volunteer Hours: 16.0		Maximum	*	*	1.50	9.5	11.1	34.0	32.0
James River @ Enon	43	Minimum	1.4	*	0.30	6.5	4.5	5.5	0.0
WaterTrends Station ID: 8		Median	2.0	*	0.60	7.5	8.6	19.0	21.0
Volunteer Hours: 60.8		Maximum	3.1	*	0.80	9.0	10.9	32.0	39.0
Falling Creek Reservoir	49	Minimum	0.9	*	0.55	6.0	5.4	15.0	13.0
WaterTrends Station ID: 100		Median	1.6	*	0.79	6.5	7.9	22.0	22.0
Volunteer Hours: 56.8		Maximum	7.2	*	1.30	7.5	11.7	31.0	36.0
Walton Lake	27	Minimum	0.8	*	0.26	6.0	2.9	12.0	12.0
WaterTrends Station ID: 200		Median	1.3	*	0.84	7.0	4.1	22.0	23.0
Volunteer Hours: 25.1		Maximum	2.7	*	1.28	7.0	6.8	28.0	31.0

pH

Observations of pH indicated that the majority of measurements made fell within the acceptable 6.0 to 9.0 unit range specified by the Virginia Department of Environmental Quality. There was one instance in which this range was exceeded. At the James River Station 7 (Henricus Historical Park), a measurement of 9.5 units was recorded on September 15th during relatively normal river conditions. There was no indication as to why the reading was so high but it was most likely due to increased algal activity in the relatively low flow areas near the shore. Increased algal activity can influence pH measurements by the removal of carbon dioxide from the water via the process of

photosynthesis. This removal can lead to localized decreases in the carbonic acid concentration of the water and thus drive the pH toward the basic end of the scale. Since this incident was an isolated event, it was not necessary to investigate, however pH measurements will need to be carefully reviewed at this site, as well as others, in case readings are continually low or high. Several individual measurements as well as monthly medians during the course of the year were at the lowermost limit of acceptability (6.0 units), a common occurrence for surface waters in Chesterfield County due to natural conditions.

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Dissolved Oxygen

Dissolved oxygen concentrations were for the most part excellent among all sites with only a few observations not meeting the minimum 4.0 mg/L VADEQ standard. During the summer months, low dissolved oxygen was observed at several stations. The monthly medians for June and July at Swift Creek (Station 4) and Walton Lake (Station 200) ranged from 3.4 to 3.8 mg/L. At Rockwood Park (Station 3), the monthly median dissolved oxygen concentration within the Tributary to Falling Creek was 3.9 mg/L in August. The lowest value recorded during 2008 was 1.9 mg/L at Swift Creek (Station 4) observed on July 6th. Low dissolved oxygen concentrations are typically noted in summer, especially in slow moving/sluggish streams or in still lakes. As the temperature increases, the ability of the water to hold oxygen diminishes and results in the lower concentrations. Most streams, rivers and lakes have areas that possess higher concentrations providing fish and aquatic life a refuge from the lack of oxygen, however if the condition is too widespread, fish kills may occur.

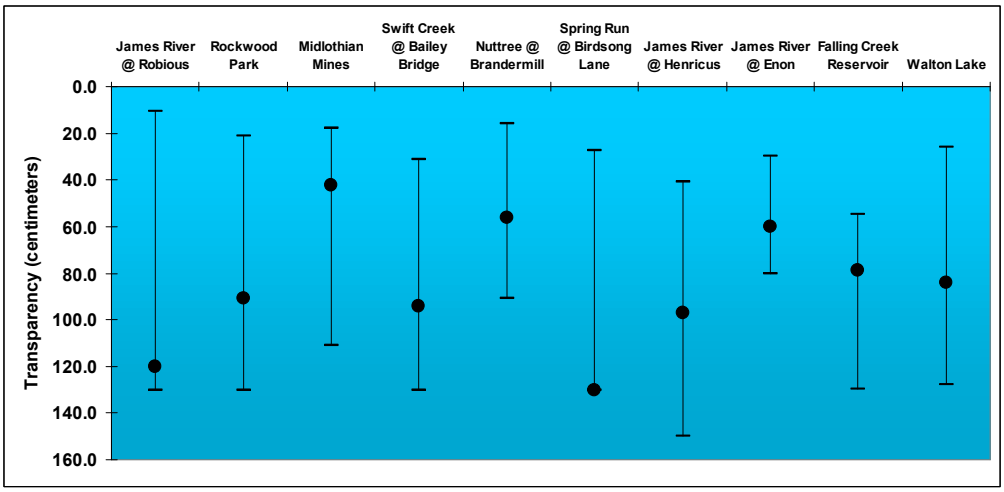
Temperature

Monthly median temperatures and individual measurements varied normally according to season. There were two instances in July at the James River Station 7 (Henricus Historical Park) where the temperature exceeded the 32^{o}C VADEQ standard. These two readings (34.0^{o}C each), as well as the July median (34.0^{o}C) exceeded the VADEQ standard of 32.0^{o}C, due most likely to thermal influences from the Dominion Virginia Power effluent area upstream of the park. Additionally, surface water temperatures at the other two James River stations (Robious Park and Enon) approached or were at the 32^{o}C limit during the summer months of 2007 but did not exceed it. The few high temperatures observed at these sites are attributed to natural conditions related to the ability of large bodies of water to retain heat rather than thermal inputs from the watershed. The lowest monthly median temperature (3.0^{o}C) occurred at Station 2, Tributary to Falling Creek within Rockwood Park during January.

Transparency

Water clarity was measured by use of a 120 cm turbidity tube (Stations 1-6) or a standard eight-inch Secchi disk (Stations 7-8, and lakes) with all readings and statistics expressed in this section as centimeters for comparison purposes (Figure 1). The greatest annual median transparency was observed in the James River at Robious Landing Park (Station

1; 120.0 cm) and in Spring Run (Station 6; ≥ 130.0 cm). The least clear waters were observed at the Tributary to Falling Creek in the Midlothian Mines Park where the annual median transparency was calculated as 42.4 cm. Decreased turbidity can be caused by a variety of factors including abundant plant and algae growth or by suspended fine



particulate matter in the stream or lake water column.

Figure 1. Annual median transparency measurements at each monitored station, 2008. Graph depicts annual median value and range of observations. Secchi disk depths recorded at the James River stations (Henricus and Enon) and Falling Creek Reservoir and Walton Lake have been converted from meters to centimeters for comparison.

General Observations

Volunteers made visual observations of water quality and wildlife during each survey with station specific records of observations included in Appendix A. Overall, the monitored waters were stained brown to various degrees. Occasional reports of clear, turbid and green colored water were also recorded. Generally, very few unpleasant odors were recorded and when odors were noted they were usually described as "earthy". As in past reports, the most common "trash" item continued to be litter and leaves/debris from the watersheds. A substantial *Cylindrospermopsis raciborskii* algae bloom was reported on Walton Lake during August that imparted a characteristic orange/brown tint to the lake's water. A variety of wildlife was observed to include numerous waterfowl, fish and turtles.

Future Goals

The Chesterfield WaterTrends Program will continue to be implemented in 2009 with emphasis on adding new sites and maintaining current stations. The Chesterfield WaterTrends Program will be supported with the aid of a 2009 Virginia Department of Environmental Quality (VADEQ) Citizen Water Quality Monitoring Grant. This grant will allow for the recruitment of additional program volunteers through the development

of a program brochure. The grant will also support the purchase of additional monitoring supplies.

Training and recertification sessions will be held in April and October. Other training opportunities will be explored and developed for monitors including low gradient habitat assessments, data use and management and biological monitoring. The data from this program will help determine trends in water quality as development in the watersheds change.

Chesterfield WaterTrends will finalize a Quality Assurance Project Plan (QAPP) through the VADEQ in 2009. This QAPP is a component of the VADEQ 2009 Citizen Water Quality Grant. This QAPP will cover the chemical monitoring program on streams, rivers and lakes. The QAPP may be modified in the future to cover additional parameters as training programs are developed. Chesterfield WaterTrends data is also being entered in the VADEQ Virginia Volunteer Non-Agency Database.

In 2008, monitors participated in the Great North American Secchi Dip-In. This event is sponsored by Kent State University in Ohio. This national event has been collecting lake data since 1994. The purpose of the event is to provide a national perspective of water clarity, as well as to promote volunteer monitoring at the national level. Data from this event can be found at *www.dipin.kent.edu*. We will encourage monitors to participate in this program in 2009.

We hope to utilize the data collected by the monitors in educational programs for county residents. The data can be presented to citizens and used to facilitate discussions on how they can help improve the water quality through proper lawn care techniques, pet waste disposal and other practices.

Chesterfield County WaterTrends Monitors

Much thanks and appreciation is given for the selfless volunteers who brave the elements to acquire data that assists in the protection of Chesterfield County's waters. Their stewardship is commendable. We would also like to thank our Trainer and QC Officer, Peggy Sleevi, for her countless hours both training volunteers and ensuring the quality of our data.

Station 1	The Isman Family and Sanford Beyer
Station 2	The Luck Family and Christie Bondruant
Station 3	The Perdue Family
Station 4	The Roussos Family
Station 5	Marcie Williams
Station 6	Tom and Gretchen Cole
Station 7	Pete Nicholson
Station 8	Jim Turner
Station 100	The Falling Creek Reservoir Preservation Society
Station 200	John Burmeister